

EXHIBIT 1

META-ANALYSIS



Systematic Review and Meta-analysis: Effectiveness of Wraparound Care Coordination for Children and Adolescents

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Objective: Wraparound is a common method for coordinating care for children and adolescents with serious emotional disorders (SED), with nearly 100,000 youths served annually in the United States. The current systematic review and meta-analysis estimated effects on youth outcomes (symptoms, functioning, school, juvenile justice, and residential placement) and costs.

Method: A literature search identified 17 peer-reviewed and gray literature studies meeting criteria, which were coded on characteristics of sample, design, implementation, and outcomes. Random effects modeling was conducted using Comprehensive Meta-Analysis Version 3.0. Effect sizes were calculated using Hedges g . Homogeneity of effects were assessed using Q statistics.

Results: Medium-sized effects favored Wraparound-enrolled youths for costs ($g = 0.391$, $CI = 0.282-0.500$, $p < .001$), residential outcomes ($g = 0.413$, $CI = 0.176-0.650$, $p = .001$), and school functioning ($g = 0.397$, $CI = 0.106-0.688$, $p = .007$); small effects were found for mental health symptoms ($g = 0.358$, $CI = 0.030-0.687$, $p = .033$) and functioning ($g = 0.315$, $CI = 0.086-0.545$, $p = .007$). Larger effects were found for peer-reviewed studies, quasi-experimental designs, samples with a larger percentage of youths of color, and Wraparound conditions with higher fidelity.

Conclusion: Results indicate positive effects for Wraparound, especially for maintaining youths with SED in the home and community. However, many studies showed methodological weaknesses, and fidelity measurement was largely absent, suggesting a need for additional research. Nonetheless, the results should aid decisions around resource allocation, referral practices, and system partnerships among child psychiatrists and other behavioral health professionals.

Key words: wraparound, care coordination, meta-analysis, youth, mental health

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Ten percent of all children and adolescents in the United States, about 7 million total, are estimated to have serious emotional disorder (SED),¹ defined as the presence of 1 or more psychiatric disorders that result in impaired functioning at home, school, and/or community settings.² Although all childhood psychiatric disorders are associated with poorer outcomes than in the general population,³ youths with SED are at even greater risk for future problems, including educational failure, risk-taking behavior, substance misuse, juvenile offending, and lower quality of life.^{4–7}

Although children and adolescents with SED are more likely to require specialized and intensive interventions than youths with lower levels of functional impairment,^{3,8} behavioral health systems lack adequately intensive and effective community-based services for these youths.^{1,9–11} Negative past experiences with services, lack of insurance coverage, challenges in navigating complex and siloed systems, and

stigmatization of youths with SED and their families all combine to further reduce the use of intensive community-based services.^{9,12} With effective community-based options for youths and families lacking, many states and jurisdictions rely on costly and disruptive residential and inpatient care to attempt to meet the needs of youths with the most serious and complex needs.^{9,13–17}

To build more effective and responsive community-based treatment approaches for youths with SED, some jurisdictions have adopted manualized evidence-based treatments (EBTs), which have demonstrated effectiveness and cost savings.^{11,18–23} Uptake of these strategies has, however, been hampered by an array of barriers^{24–27} and account for less than 3% of all care provided to youths with SED.²⁸

As an alternative—or complementary—strategy to providing an array of EBTs, some states and systems have invested in care coordination models such as the Wraparound process. Wraparound is an intensive, structured

process that convenes a team of youths, caregivers, and family members, along with professionals and natural supports relevant to a youth with SED and their family.^{29,30} This child and family team, or “Wraparound team,” develops, implements, and monitors success of an individualized plan of care based on the youth’s and family’s underlying needs and perspective.^{31–34} A Wraparound care coordinator with a low caseload (eg, 8–12 families at a time) facilitates this process and directs its 4 phases: (1) engagement, (2) plan development, (3) implementation, and (4) transition.²⁹

Ideally, within these 4 phases, evidence-informed elements of Wraparound are undertaken, including engaging the youth and family, identifying and overcoming barriers, building team morale and cohesion, selecting and monitoring evidence-based strategies and services, identifying and engaging social supports for the youth and family, and using routine monitoring of outcomes and processes to direct changes to the plan of care and to facilitate transition.³⁵ Wraparound’s theory of change^{35,36} proposes 2 routes to more positive outcomes for youths with SED: (1) more effective selection and coordination of individual strategies in a youth’s plan of care (including EBTs); and (2) highly supportive, family-driven, and strengths-based planning and follow-on support that builds youth and family optimism, self-efficacy, social support, and skills.

Surveys show that nearly every state uses Wraparound care coordination, for as many as 10,000 youths statewide.³⁷ Wraparound’s use is facilitated by its ready reimbursement via Medicaid³⁸ and fewer exclusion criteria than most EBTs. Wraparound can thus be used as a care management strategy for youths with complex needs across multiple sectors, not just behavioral health, but also child welfare,^{39,40} education,⁴¹ and juvenile justice.^{42–44}

Although Wraparound is now implemented in most states in the United States, and is classified as an effective or promising practice in many inventories,^{45,46} until recently the evidence base on Wraparound was viewed as poorly developed.^{47,48} A 2009 meta-analysis of 7 experimental and quasi-experimental outcome evaluations of Wraparound found significant effects of Wraparound for residential restrictiveness, symptoms and functioning, and school and community adjustment.⁴⁹ However, the number of studies was small, and several of the studies demonstrated serious methodological deficiencies. Moreover, although implementation was noted to be poor, several early studies found null effects.^{35,50}

Since the 2009 meta-analysis, Wraparound research has grown considerably, spurred by publication of detailed descriptions of Wraparound practice,^{29,51,52} development of fidelity measures^{53,54} and training material,³⁶ explication

of necessary system conditions,⁵⁵ and publication of implementation standards.⁵⁶ A recent narrative review found 206 publications that focused on Wraparound care coordination, including 22 controlled (experimental or quasi-experimental) studies.⁵⁷ Of these, 15 showed positive results of Wraparound compared to the comparison condition, and none found better outcomes for treatment as usual (TAU) groups. However, this review did not use stringent inclusion criteria or conduct summative analyses to determine significance and/or size of overall effects.

The purpose of the current study was to conduct an updated meta-analysis of Wraparound, focused specifically on rigorous outcome evaluations. Because of the growth in the Wraparound research base, the research team was able to set more stringent inclusion criteria than those used in the previous meta-analysis.⁴⁹ The increased size of the literature also enabled the research team to conduct subgroup analyses to examine possible causes for heterogeneity of effects across studies by comparing differences in effect sizes by publication type, study design, participant characteristics, and levels of Wraparound fidelity. Primary research questions were as follows:

1. Compared to TAU, what effects does Wraparound have on youth outcomes, including mental health symptoms, mental health functioning, juvenile justice outcomes, school functioning, and residential placement?
2. Compared to TAU, what effects does Wraparound have on service costs for youths with SED?
3. What study factors account for variation in effect sizes, including type of publication (peer reviewed versus gray literature), study design (experimental versus quasi-experimental), participant characteristics (relative proportion of White youths versus youths of color), and level of adherence to the Wraparound model?

METHOD

This systematic review and meta-analysis has been structured according to the PRISMA recommendations.⁵⁸

Study Selection

Studies were identified through a combination of computerized database searches and efforts by members of the research team’s professional network to compile relevant Wraparound evaluation reports from the children’s mental health field. Peer-reviewed articles were identified in the fall of 2019 through keyword searches using the following databases: PsycINFO, ERIC, PubMed, Social Work Abstracts, and Web of Science. Search terms included:

“Wraparound” OR “Wrap-Around” OR “Wrap Around” OR “Wraparound Services” OR “Wraparound Process” OR “Intensive Community-based Services” OR “Targeted Care Management.” Dissertations and theses were identified via the Dissertation Abstracts International database, and gray literature was identified through searches using OpenGrey and Google Scholar using the same keywords as listed above. Finally, the study authors messaged established Wraparound practitioners, researchers, and National Wraparound Initiative (NWI; www.nwi.pdx.edu) Listserv members in the spring of 2019 to identify additional studies.

To be included in the final meta-analysis sample, all studies had to meet 5 specific criteria:

1. The study examined outcomes for youths between 3 and 21 years of age;
2. The study examined outcomes commonly addressed by Wraparound, including mental health symptoms, mental health functioning, juvenile justice, school functioning, residential outcomes, and costs;
3. The study used an experimental or quasi-experimental design;
4. The study was published after 1991 (the year of the first publication focused on Wraparound as a defined care coordination model); and
5. The study was published in a peer-reviewed academic journal, non—peer-reviewed gray literature, or a dissertation/thesis.

For all studies that met the above criteria, a more detailed full-text review was conducted to confirm that the program studied was consistent with the definition of “Wraparound care coordination.” Based on published, widely cited principles,⁵⁹ key activities,³⁴ and system- and organization-level implementation standards,⁵⁶ inclusion criteria included the following:

1. The program or strategy used individualized Wrap-around or child and family teams;
2. Wraparound teams included, at a minimum, the parent/caregiver, youth (if 11 years or older), and a care coordinator responsible for facilitating the process;
3. Wraparound teams met regularly (no less than every 45 days);
4. Each youth/family had a regularly updated, individualized plan of care (or Wraparound plan) that included treatment strategies and other supports;

5. The parent/caregiver, youth, and family members were central to decision making (eg, around prioritization of needs, team membership, and strategies and services included in the plan);
6. Data were collected and used to monitor progress and revise plans of care;
7. The program adhered, at a minimum, to the following principles: use of natural/community supports; needs-based (ie, strategies and services were linked to specified needs statements); and strengths-based (ie, strengths of the youth, caregiver(s), family, and team members were elicited, recorded, and used as the basis for strategies in the plan of care).

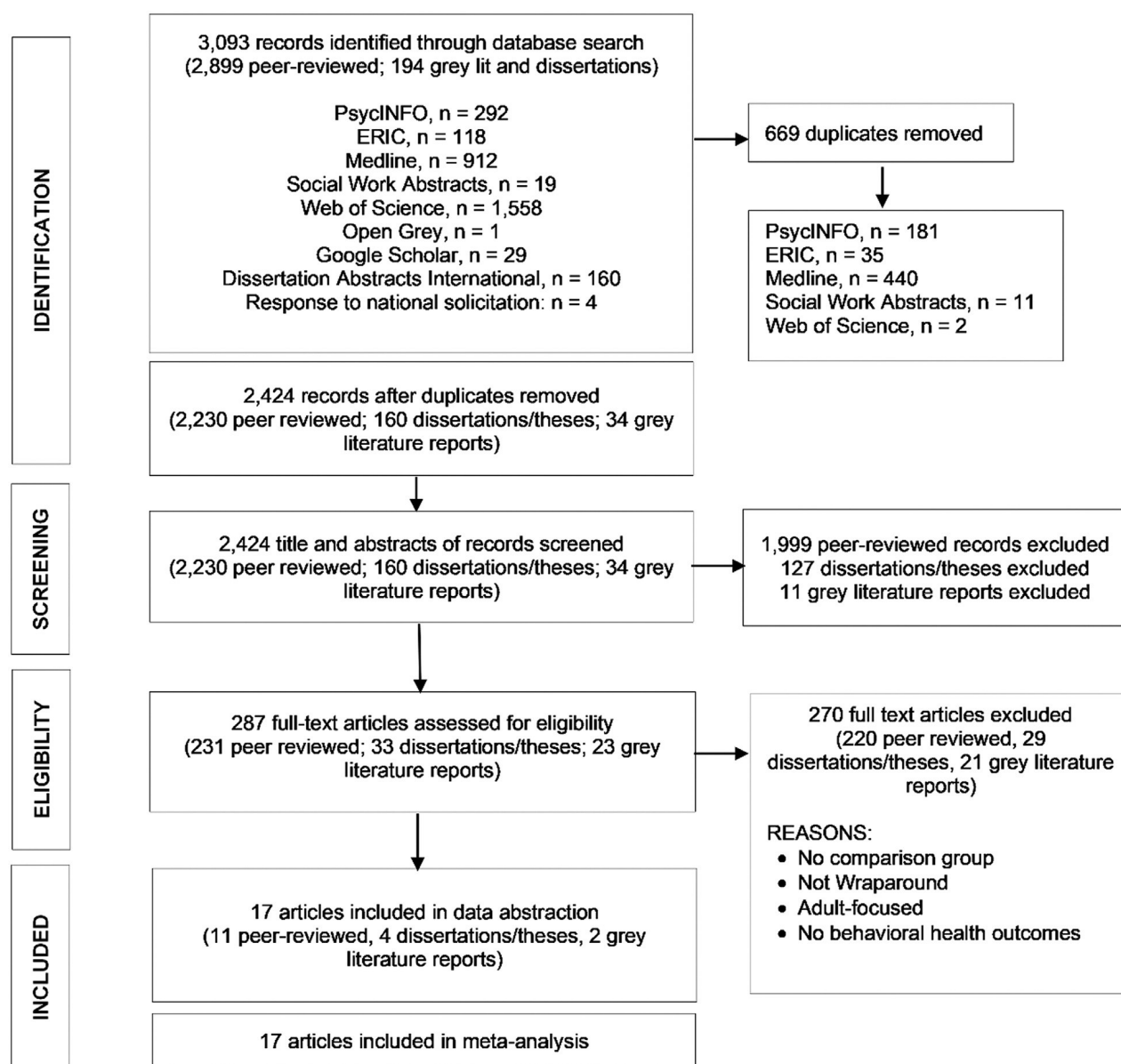
Under the guidance of a senior research scientist, a team of research assistants conducted the preliminary database searches, removed duplicate studies, and screened titles and abstracts to identify evaluations that met the first set of 5 criteria outlined above. A separate team conducted a full-text review of all studies that passed through the initial screen. At this stage, a pair of reviewers assessed the degree to which the intervention described in each study met the definition of Wraparound care coordination as operationalized above. Discrepancies in coding were minimal and were resolved through a full-team consultation. Two substantive discrepancies that did occur resulted from a lack of detail in the published paper; in these instances, the last author solicited additional information from study authors to make a final determination. The flow of the study identification, screening, and selection process is presented in [Figure 1](#).

Variable Coding

The 17 studies ultimately included were reviewed and coded for study design (experimental, quasi-experimental); sample size; demographics (gender, race, ethnicity, age); Wraparound fidelity metrics; and outcomes assessed. We attempted to code additional covariates, including attrition rates, intent to treat (ITT) analysis, youth presenting problems, diagnoses (including severity), funding, treatment length, modes of delivery, caseload sizes, and staff characteristics; but these variables were seldom presented in the articles and/or reports and were not available from study authors because they were not collected. In addition, although many authors provided a brief description of comparison group treatments, most were described as TAU, and did not include enough detail to code specific characteristics.

Outcomes

For each study, effect sizes were calculated for the following outcomes described below.

FIGURE 1 Flow of Information of Information Through Stages of Review

Mental Health Symptoms. Six studies assessed mental health symptoms and emotional and/or behavioral problems. Measures included the Child Behavior Checklist (CBCL),⁶⁰ the Youth Self-Report (YSR),⁶¹ and the Behavioral and Emotional Rating Scale—Second Edition (BERS-2).⁶²

Mental Health Functioning. Nine studies examined mental health functioning within participants' homes, schools, and communities, as measured by the Child and Adolescent Functional Assessment Scale (CAFAS)⁶³ and/or parent self-report based on interviews and/or surveys.

Juvenile Justice. Five studies examined contact with juvenile justice systems as assessed by juvenile court records, academic records, and/or parent interviews.

School Functioning. Four studies included measures of school functioning, assessed through client status reports, academic records, and/or parent reports.

Residential Outcomes. Nine studies examined residential outcomes, operationalized as more stable and/or less restrictive placements, and were assessed via foster care payment records, Medicaid claims, and/or interviews. For some

studies, residential outcomes were dichotomous (ie, placed in a restrictive setting such as inpatient or residential treatment or not); for others, restrictiveness of residential placement was quantified using the Restrictiveness of Living Environment Scale (ROLES).⁶⁴

Costs. Three controlled studies that focused on cost outcomes were included, 2 of which also included 1 or more of the above-mentioned behavioral health outcomes. Two studies analyzed Medicaid claims data, and the third used administrative records to estimate the costs of Wraparound and TAU.

Data Analysis

A summary of all studies included in the meta-analysis is presented in Table 1.^{65–76} All analyses were conducted using Comprehensive Meta-Analysis Version 3.0.⁷⁷ We estimated effect sizes of standardized mean differences using Hedges' *g*, with a 95% CI. Hedges' *g* provides estimates similar to Cohen's *d*, but is less reactive to small sample sizes.⁷⁸ Homogeneity of effects were assessed using *Q* statistics. Results suggested heterogeneity across effect sizes for most outcomes, which was expected given variability in methodologies, demographics, and outcomes across studies (see Table S1, available online). Given these findings, we used random-effects models for all analyses because such models better reflect heterogeneity of effects as compared to fixed-effects models.^{79,80} In addition, we conducted subgroup analyses to examine heterogeneity of effects by comparing effect sizes across 4 sets of groups: (1) peer-reviewed versus gray literature; (2) randomized versus quasi-experimental designs; (3) samples with higher percentages of youths of color versus those with lower percentages of youths of color; and (4) experimental conditions with adequate versus suboptimal Wraparound practice fidelity.

Effect Size Calculation. Studies included used a wide variety of measures to assess each outcome, and in some cases included multiple measures of a similar construct (eg, multiple assessments of mental health symptoms). To represent the full range of reported outcomes, while avoiding the problem of non-independent information in the analysis, we calculated mean effect sizes within each study before calculating cross-study effects using procedures suggested by Lipsey and Wilson⁸¹ and Borenstein *et al.*^{77,82} Although this approach does not eliminate reporting biases in outcome evaluations, it can help minimize bias by including all available indicators of each construct. To assess the first research question, we used this approach to calculate separate effect sizes for each of the 5 youth outcomes, excluding costs, and then we calculated an overall combined outcome effect size that was based on a weighted average of the

5 outcomes.^{77,81} To assess the second research question, we followed a similar approach to calculate a separate overall effect size for intervention costs.

Finally, we repeated the analyses on youth outcomes (excluding costs) for 4 subgroups. First, to assess for possible publication bias, we examined effect sizes for peer-reviewed (*n* = 10) versus non-peer-reviewed (*n* = 6) literature. We further examined potential biases within the sample of peer-reviewed and gray literature studies by creating a funnel plot and using Egger's test for asymmetry.⁸³

Next, we compared effect sizes across 3 additional subgroups. First, we compared effects for experimental (*n* = 8) versus quasi-experimental designs (*n* = 8). Second, for the 14 studies that provided adequate information, we calculated the median percentage of Black, Indigenous, and People of Color participants (53.5%). We then used this result to assign all studies to 1 of 2 groups: greater representation of youths of color (*n* = 7; mean = 72.2% youths of color) versus less representation of youths of color (*n* = 7; mean = 37.2% youths of color), and compared effects for these 2 groups. Third, for 5 studies that reported Wraparound practice fidelity as measured by the Wraparound Fidelity Index (WFI),⁵⁴ we compared effects for those in which fidelity for the Wraparound condition was at least "average" (*n* = 3) versus "below average" (*n* = 2), using standards previously established by research using norm-referenced and criterion-referenced approaches.⁸⁴

RESULTS

Study Characteristics

The final sample for this meta-analysis included 11 peer-reviewed studies, 2 technical reports, 3 doctoral dissertations, and 1 Master's thesis. Eight of these studies used randomization, and 9 used a quasi-experimental design (7 of which used propensity score methods to construct a matched comparison group). Sample sizes ranged from *N* = 29 to *N* = 20,283 (median = 141). Follow-up data collection time points ranged from 6 months to 2.5 years. Additional study characteristics including selected demographics are included in Table 1.

Outcomes

Overall Effect Sizes for Combined Outcomes. Effect sizes for combined outcomes were calculated for the 16 studies that measured youth outcomes. Outcomes for each individual study were averaged and Hedges' *g* was calculated based on weighted averages across the studies. Combined outcomes favored Wraparound; the effect size was small per Cohen's conventions⁸⁵ and statistically significant (0.277, CI = 0.119–0.435, *p* = .001). Across studies, 1 study found

TABLE 1 Characteristics of Studies Included in Meta-analysis

Authors	Publication type	Design	Outcomes	Fidelity level	Mean age (y)	N (all)	n (int)	n (comp)	% Female participants	Race/ethnicity (%)	Follow-up
Browne et al., ⁶⁵ 2016	Peer-reviewed	A single blind randomized controlled trial	MHF, MHS	Low	All: 6.5 Int: - Comp: -	135	67	68	47.4	N/A	20 mo
Bruns et al., ⁶⁶ 2006	Peer-reviewed	Quasi-experimental with matching	MHF, MHS, Res, School	Medium	Int: 12.4 Comp: 11.4	65	33	32	Int: 45 Comp: 53	White: 46	3, 6, 12, and 18 mo
Bruns et al., ²⁸ 2015	Peer-reviewed	Randomized controlled design	MHF, MHS, Res	Low	All: 11.9 Int: - Comp: -	93	47	46	43	White: 39 Black: 41 Native Am.: 1 Multi-race: 12 Other: 8 Hispanic: 16	6, 12 mo
Carney and Buttell, ⁴² 2003	Peer-reviewed	Randomized controlled design	JJ, MHF, School	N/A	All: 14.8 Int: 14.8 Comp: 14.9	141	73	68	38	White: 50.4 Black: 48 Multi-race: 1	6, 12, and 18 mo
Coldiron et al., ⁶⁷ 2019	Peer-reviewed	A longitudinal randomized control trial	JJ, Res, School	Medium	All: 16 Int: 15.9 Comp: 16	47	24	23	34	White: 25.5 Black: 63.8 Hispanic: 10.6	20 mo
Clark et al., ³⁹ 1996	Peer-reviewed	Randomized controlled study	MHF, Res	N/A	7 to 15	132	54	78	N/A	N/A	2.5 y
Grimes et al., ⁶⁸ 2011	Peer-reviewed	Quasi-experimental with matching	Res, Cost	N/A	3 to 18	20,283	100	20,183	33	White: 47 Black: 11 Other: 11 Hispanic: 21	12 mo
McCarter, ⁶⁹ 2016	Peer-reviewed	Randomized controlled study	MHF, MHS	N/A	Int: 14.6 Comp: 14.2	29	22	7	Int: 18.1 control: 14.3	White: 20.7 Black: 69 Other: 4.5	6 mo
Mears et al., ⁴⁰ 2009	Peer-reviewed	Quasi-experimental design with three nonequivalent comparison groups	JJ, MHF, MHS, Res, School	N/A	All: 12.3 Int: 12.4 Comp: 12.7	126	48	48	37	White: 61 Black: 17 Native Am: 6.3 Other: 13 Hispanic: 16	6 mo
Pullmann et al., ⁴⁴ 2006	Peer-reviewed	Nonequivalent comparison group match	JJ	N/A	All: 15.2 Int: 15.4 Comp: 15	204	106	98	31	White: 88.4 Other: 11.6	790 days
Snyder et al., ⁷⁰ 2017	Peer-reviewed	Nonequivalent comparison with matching	Cost	N/A	6–20	485	161	324	Int: 38.51 control: 40.12	N/A	21 mo (average)
West Virginia Dept of Health and Human Resources, ⁷¹ 2018	Gray literature	Nonequivalent comparison historical group match	Res	N/A	<18	2631	1544	1087	Int: 40.5	White: 85.3 Black: 5.7 Multi-race: 8.5 Other: 2.2	Within 6 and 12 mo post-referral
Rauso et al., ⁷² 2009	Gray literature	A static-group comparison	Res, Cost	N/A	Int: 13.4 Comp: 14.5	220	43	177	Int: 30 Comp: 45	White: 20.6 Black: 41.9 Other: 4 Hispanic: 33.8	12 mo
Carney, ⁷³ 1996	Dissertation	Randomized experimental design	JJ	N/A	Int: 14.8 Comp: 15.2	208	50	158	36.5	White: 47.6 Black: 50 Multi-race: 2.4	6 times a year for 1 y
Ferguson, ⁷⁴ 2004	Dissertation	Randomized control group design	Res	Medium	All: 12.1 Int: 12.2 Comp: 12.0	194	121	73	38.14	White: 15.5 Black: 76.7 Hispanic: 6.7	20 mo

(continued)

TABLE 1 Continued

Authors	Publication type	Design	Outcomes	Fidelity level	Mean age (y)	N (all)	n (int)	n (comp)	% Female participants	Race/ethnicity (%)	Follow-up
Walton, ⁷⁵ 2006	Dissertation	Nonequivalent comparison with matching	MHF, MHS	N/A	Int: 11.7 Comp: 11.2	772	386	386	Int: 32.6 Comp: 42.2	White: 60.2 Black: 27.6 Native Am.: 0.7 Multi-race: 6.7 Other: 4 Hispanic: 7.4	6 or 12 mo (most common)
Hensley, ⁷⁶ 2019	Master's thesis	Retrospective cohort study design, propensity score-matched comparison group	MHF	N/A	Int: 13.6 Comp: 13.5	244	122	122	Int: 45 Comp: 47	White: 27.5 Black: 22 Other: 12 Hispanic: 38	6 mo

Note: Comp = comparison group; dept = department; int = intervention group; JJ = juvenile justice outcomes; MHF = mental health functioning; MHS = mental health symptoms; N/A = not available; Native Am = Native American; Res = residential outcomes.

a very small negative effect size (-0.048 CI = -0.600 to 0.504 , $p = .865$), and all others had positive effect sizes that ranged from very small to large (Figure 2).

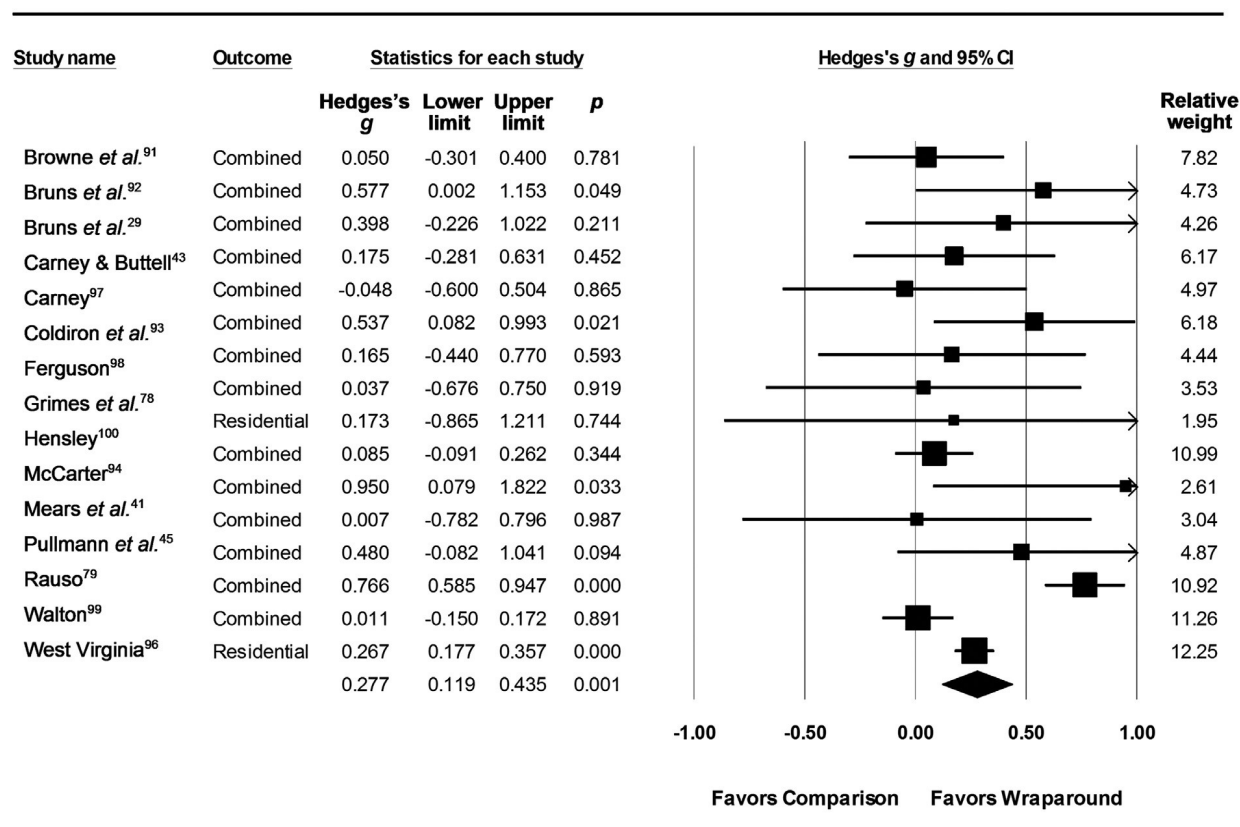
Effects for Individual Outcome Domains. Effect sizes for individual outcomes ranged from small to moderate (Table 2). The largest effects were observed for residential outcomes, with a medium and statistically significant effect size that favored Wraparound youths compared to those receiving TAU ($g = 0.413$, CI = $0.176-0.650$, $p = .001$). Similar effect sizes were observed for school functioning ($g = 0.397$, CI = $0.106-0.688$, $p = .007$) and mental health symptoms ($g = 0.358$, CI = $0.030-0.687$, $p = .033$). We observed a smaller, but still significant, effect size for mental health functioning ($g = 0.315$, CI = $0.086-0.545$, $p = .007$), and a nonsignificant effect for juvenile justice-related outcomes ($g = 0.127$, CI = -0.138 to 0.391 , $p = .347$).

Cost Outcomes. Three studies specifically assessed the effects of Wraparound care coordination on costs compared to TAU. Results showed a medium effect size with Wraparound associated with lower costs than TAU ($g = 0.391$, CI = $0.282-0.500$, $p < .001$). However, these findings are tempered by the fact that of the 3 studies included in this analysis, 1 reported a large effect size related to costs ($g = 0.825$), whereas the other 2 studies reported small effects ($g < 0.180$).

Subgroup Analyses

Publication Type. Comparison of the 10 peer-reviewed versus 6 gray literature studies focused on youth outcomes found larger effect sizes for combined outcomes among peer-reviewed studies ($g = 0.302$, CI = $0.128-0.476$, $p = .001$) compared to gray literature ($g = 0.227$, CI = -0.016 to 0.472 , $p = .067$). Because of the small number of gray literature evaluations, only 2 individual outcomes were assessed in more than 1 study: the effect size for mental health functioning was much larger for peer-reviewed studies ($g = 0.486$, CI = $0.180-0.792$, $p = .002$) than for gray literature studies ($g = .019$, CI = -0.099 to 0.136 , $p = .753$); but the effect size for residential outcomes was slightly larger for gray literature studies ($g = 0.418$, CI = -0.006 to 0.843 , $p = .053$) than for peer-reviewed studies ($g = 0.398$, CI = $0.123-0.674$, $p = .005$) (see Table S2, available online).

Funnel plot analysis of all studies indicated a symmetric shape (Figure 3), a finding confirmed by a nonsignificant Egger's test (bias = 0.142 , CI = -1.44 to 1.73 , $p = .850$). When repeated with only peer-reviewed studies to determine whether there was evidence of selective publication of findings, analyses again demonstrated a symmetric shape

FIGURE 2 Forest Plot for Combined Outcomes

and nonsignificant Egger's test (bias = 1.063, CI = -1.14 to 3.27, $p = .298$). Together, these findings suggest that, although effect sizes differ across peer-reviewed and gray literature studies, the current meta-analytic sample is representative of effect sizes commonly observed for Wraparound.

Study Designs. Effect sizes for combined youth outcomes were larger for the 8 quasi-experimental studies ($g = 0.304$, CI = 0.081–0.527, $p = .008$) than for the 8 studies that used a randomized experimental design ($g = 0.219$, CI = 0.035–0.403, $p = .020$). At the individual outcome level, the effect size for residential outcomes was larger in quasi-experimental than in randomized designs. However,

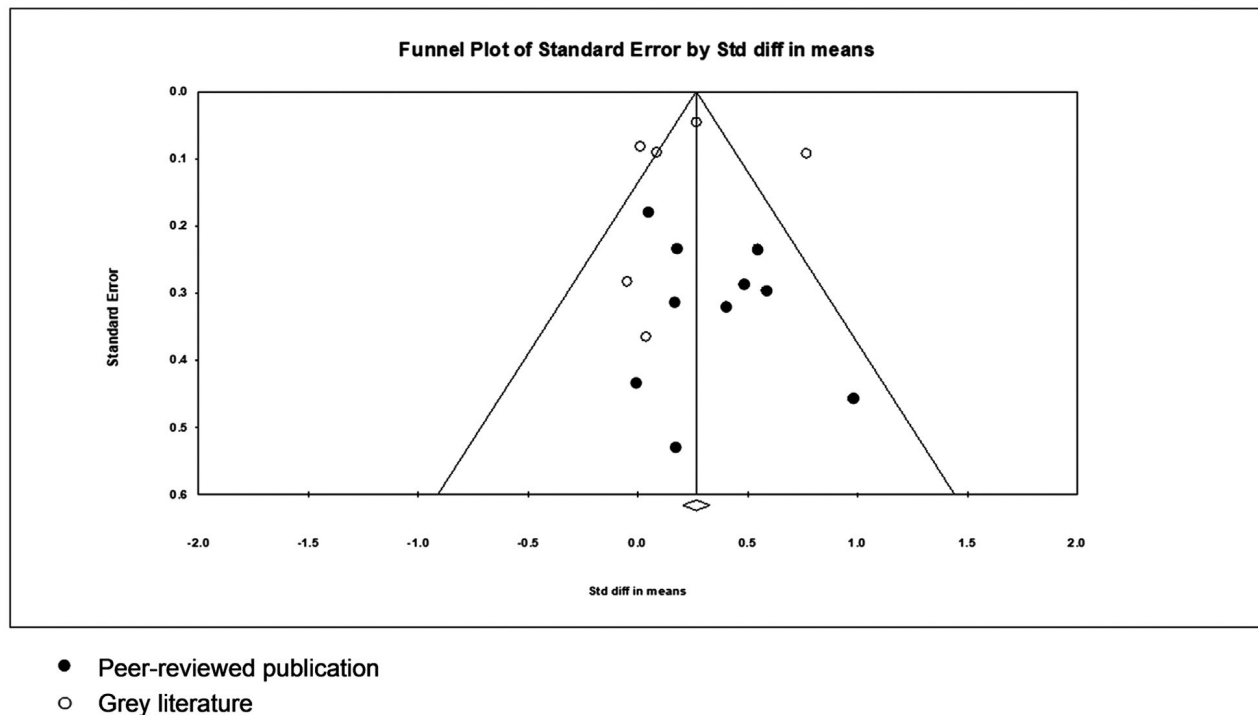
effect sizes for mental health symptoms, mental health functioning, and school functioning were larger for randomized studies (see Table S3, available online).

Race/Ethnicity. The combined effect size for studies with greater representation of youths of color ($g = 0.413$, CI = 0.072–0.753, $p = .018$) was larger than for studies with more White youths ($g = 0.162$, CI = 0.015–0.308, $p = .030$). Effect sizes for all individual outcomes were larger in studies with higher percentages of youths of color; however, significant effects were only found for mental health symptoms, school functioning, and residential outcomes (see Table S4, available online).

Adherence to Wraparound. Effect sizes for combined youth outcomes were higher for studies with at least “average” levels of Wraparound fidelity ($g = 0.294$, CI = -0.066 to 0.654, $p = .110$), compared to below-average or unacceptable fidelity ($g = 0.133$, CI = -0.172 to 0.439, $p = .392$). However, because of low statistical power, neither of these effects was statistically significant. Effect sizes for individual outcomes were consistently higher among the higher-fidelity subsample compared to the low-fidelity subsample. However, most of these outcomes were assessed

TABLE 2 Effect Sizes for Individual Outcomes

Outcome category	All studies		
	Hedges' <i>g</i>	95% CI	<i>p</i>
Mental health symptoms	0.358	0.030–0.687	.033
Mental health functioning	0.315	0.086–0.545	.007
Juvenile justice	0.127	-0.138 to 0.391	.347
School functioning	0.397	0.106–0.688	.007
Residential outcomes	0.413	0.176–0.650	.001
Combined outcomes	0.277	0.119, 0.435	.001

FIGURE 3 Funnel Plot for Peer-Reviewed and Gray Literature

only in a single study within each subgroup, and neither of the “below-average fidelity” studies assessed juvenile justice or school functioning (see [Table S5](#), available online).

DISCUSSION

Effects of Wraparound on Outcomes

The current systematic review and meta-analysis found a small but statistically significant effect for combined outcomes that favored Wraparound-enrolled youths. Across different outcome categories, significant, medium-sized effects were found for residential outcomes and school functioning; significant small effects for mental health symptoms and functioning; and nonsignificant effects for juvenile justice outcomes. In light of the heterogeneity of effects across studies and some evidence of publication bias, these findings should be interpreted cautiously; however, it is worth noting that overall effect sizes found for Wraparound are similar to mean effect sizes found for evidence-based psychosocial treatments compared to usual care.⁸⁶

Despite the heterogeneity of effects and publication biases observed in the current analysis, several factors strengthen our confidence in the overall finding that Wraparound is associated with positive outcomes for youths with SED. First, all studies compared Wraparound-enrolled youths to an active comparison group, with none of the studies using a no-treatment control group. Given the widely observed phenomenon

that behavioral health efficacy studies (and reviews thereof) often include no-treatment control groups,^{86,87} the effect sizes reported in this article are likely conservative estimates of Wraparound’s impact on behavioral health outcomes compared to those reported for many EBTs.

Second, although we did not include it as a study characteristic in formal coding, nearly all studies were conducted in authentic service systems by research teams that were not involved in delivery of care, training of practitioners, selection of samples, or other activities that have been found to inflate effect sizes found in efficacy trials.^{87–89} Thus, the nature of these studies may increase the likelihood that they will generalize readily to public systems.

Third, results are consistent with those in the Suter and Bruns⁴⁹ meta-analysis, despite very little overlap in the studies included for each outcome domain. Indeed, given the growth in research on Wraparound over the past decade, the research team conducted a new literature review rather than building on the previous analysis. The increase in number of studies enabled the team to set more stringent standards for study inclusion than was used in 2009.

Finally, effects found across outcomes were consistent with Wraparound’s mechanisms of effect and theory of change.³⁶ Unlike many EBTs, the primary goal of Wraparound is not necessarily to address symptoms or functional targets associated with a single disorder or problem type, but to develop and implement a plan capable of maintaining youths with SED in

their homes and communities. As such, it is consistent that the largest observed effects sizes were for residential placement and service costs, rather than symptoms or functioning.

Effects of Wraparound on Costs

Results also suggested lower service costs for youths served by Wraparound compared to TAU. This is not surprising, given that behavioral health costs for children are driven by use of institutional and residential care, reduction of which was also found to be a significant, medium-sized effect of Wraparound. In addition, 2 of the 3 studies of costs found significant effects on out-of-home placement.^{68,72} It is important to note that only 3 controlled studies of costs were included, and the combined effect size was influenced by a single study that found a large effect favoring Wraparound. However, findings are consistent with many other nonexperimental state and local evaluation studies that have found cost savings associated with use of Wraparound.^{43,90,91}

Characteristics of Studies

Peer-reviewed studies were associated with larger effect sizes than those published in the gray literature. Such findings are consistent with past research, as publication bias in the behavioral sciences is well documented.^{92–94} Evidence of such bias in the current study underscores the importance of considering the full range of studies included. In addition, the findings across study designs were mixed with quasi-experimental studies associated with larger effect sizes for combined outcomes and residential outcomes; and randomized designs associated with larger effects for mental health symptoms, mental health functioning, and school functioning. Such findings suggest a need for additional research on the relative influence of methodological rigor on study outcomes.

Influence of Race and Ethnicity

Subgroup analyses conducted as part of this study provide preliminary evidence that Wraparound may result in more positive effects among youths of color compared to White youths. This finding is important, given that prior research has found that children of color experience poorer behavioral health treatment outcomes than White children.⁹⁵ Theory and past research is mixed on the capacity of behavioral health EBTs to address these disparities; however, some have proposed that the structure of EBTs may reduce implicit bias in treating children of color.^{96,97} With respect to Wraparound, the systematic process of identifying individualized needs and tailoring support to meet those needs may result in particularly robust benefits to youths and families who are not well served by “treatment as usual,” including those from diverse backgrounds.

However, any such conclusions should be tempered by the limitations of this subanalysis. First, coding race and

ethnicity as a binary variable falls far short of reflecting the diversity of youths served by Wraparound. In addition, the group of studies with higher percentages of youths of color included all of the studies with “average fidelity” of Wraparound as well as a larger number of randomized designs. Thus, some of the differential effects across race might be explained by study characteristics. More research is needed on the potential for Wraparound to reduce the racial disparities that have been observed to exist in children’s behavioral health “treatment as usual.”

Influence of Practice Adherence

Findings support past research suggesting that Wraparound outcomes are influenced by practice adherence^{35,98,99} in that effect sizes for combined and individual outcomes were higher among studies reporting at least “average fidelity” compared to those with lower levels of implementation fidelity. Given the limited number of studies eligible to be included in these analyses, additional research is needed to determine whether such findings can be replicated, either via studies that experimentally manipulate pathways to Wraparound adherence, or by a review of a larger sample of studies with measured variation in practice fidelity.

The collective findings related to Wraparound outcomes should be considered in light of several limitations of the current meta-analysis. First, although all studies included in the current analysis used either experimental or quasi-experimental designs, there was substantial methodological variation. Few studies reported rates of differential attrition, and only 2 specifically noted that they used an intent-to-treat approach in their analyses. Although most studies provided detailed information on sample demographics, some failed to provide data on the comparability of intervention and comparison group members at baseline, and most authors provided only a cursory description of comparison group intervention characteristics. Several studies also failed to provide detailed data on follow-up intervals.

The studies included in this meta-analysis also varied widely in their measurement strategies. Some used established and validated indicators of behavioral health outcomes, whereas others relied on self or parental reports, and/or administrative records. The consistency in effects across studies despite such disparities in measurement could be considered a strength of this analysis; however, it also is problematic in that it is unclear whether each study is actually measuring the same underlying constructs, especially when aggregating outcomes as broad as “mental health symptoms” or “mental health functioning.” Furthermore, we cannot rule out the possibility that the generally positive effects observed across these studies was influenced by reporting biases.

Another limitation of the current analysis is that the small number of studies did not permit meta-regression

analyses that would have enabled us to control for potentially confounding factors. In addition to the small sample of studies, relevant data on potential moderators (eg, implementation fidelity, attrition rates, participant demographic characteristics) were seldom reported, and efforts to reach out to study authors yielded few additional data.

Finally, as with any review, it is possible that some studies of Wraparound were missed—particularly those in the gray literature. In addition, despite excellent agreement across reviewers, variability in Wraparound practice (and inconsistencies in reporting in articles and reports) could mean that studies of model-adherent Wraparound were excluded, or that studies of inappropriate models were included. As noted above, the lack of fidelity data makes it impossible to assess the extent of this problem.

Implications

Taken together, results suggest that Wraparound is associated with small but significant positive effects on a range of behavioral health outcomes while also serving as a less expensive alternative to TAU. Given the greater robustness of these results when compared to, for example, the first meta-analysis of wraparound effects,⁴⁹ the results should be helpful in informing referral practices and system partnerships among child psychiatrists and other mental health professionals.

Results also provide considerable relevance to policy makers. The Family First Prevention Services Act (FFPSA) of 2018¹⁰⁰ is the latest example of federal legislation that requires states to provide evidence of effectiveness of strategies for which federal reimbursement is sought. Although effects were found to be small for several important domains, Wraparound's applicability across sectors and populations is likely to bolster the case for its use. Moreover, the medium-sized effects found for placement prevention and costs is likely to be particularly appealing to policy makers, system leaders, and managed care organizations seeking to reduce reliance on congregate care and direct resources "upstream" to prevention and early intervention. The current findings also provide preliminary evidence that Wraparound may help systems and programs to achieve better outcomes for youths who have not been well served by traditional mental health services, particularly youths of color.

With respect to future research, there is a clear need for additional studies that use high-quality evaluation designs. Despite the significant growth in the Wraparound

literature base over the past decade, the current meta-analysis included only 10 peer-reviewed studies and 6 gray literature reports focused on youth outcomes (with an additional study focused on costs). Of these studies, only 8 used randomized controlled designs, and most authors failed to report (or to collect) pertinent data on demographics, attrition rates, and subgroup characteristics. The quality of measures also varied considerably across studies.

More consistent measurement and reporting of practice fidelity is needed. Of the studies examined in this analysis, only 5 reported such data. Although the focus on real-world providers within typical service systems may be viewed as strengthening generalizability, the Wraparound research base would benefit from efficacy studies that assess effects of Wraparound under more ideal conditions. Studies of Wraparound as delivered by practitioners who can achieve full fidelity to the model, working in partnership with clinicians and psychiatrists using research-based treatments, would provide critical information on the full potential of community-based Wraparound.

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Formal analysis: Olson, Pullmann, Suter, Bruns

Investigation: Olson, Benjamin

Methodology: Olson, Pullmann, Suter, Bruns

Project administration: Olson

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